

WHAT IS CLAIMED IS:

[Claim 1]

A construction method for an exhaust heat recovery boiler that generates steam by disposing a number of heat exchanger tubes in a gas duct in that an exhaust gas flows almost horizontally, a construction method for exhaust heat recovery boiler wherein,

a heat exchanger tube bundle panel module including:

a plurality of heat exchanger tube bundle panels disposed along the gas flow including a number of heat exchanger tubes, upper and lower headers of the heat exchanger tubes, and vibration restraining supports that are disposed at predetermined intervals to prevent contact between adjacent heat exchanger tubes in the direction crossing the lengthwise direction of the heat exchanger tubes;

a casing that forms the gas duct which is attached inside with a thermal insulating material to cover the outer periphery consisting of the ceiling wall, the bottom wall, and both-side walls along the gas flow of the plurality of heat exchanger tube bundle panels;

heat exchanger tube bundle panel support beams located outside the ceiling wall of the casing to become the ceiling

wall at the time of installation at the boiler construction site;

header supports that penetrate the ceiling wall of the casing and connect the upper headers and the heat exchanger tube bundle panel support beams to hang the upper headers down;

vertical module frames as vertical support members of the heat exchanger tube bundle panels located outside both side walls of the casing to become both side walls at the time of installation at the boiler construction site; and

horizontal module frames as horizontal support members of the heat exchanger tube bundle panel located outside the ceiling wall and bottom wall of the casing to become the ceiling wall and the bottom wall at the time of installation at the construction site,

is set as one module unit and a necessary number of modules are prepared in a proper size according to the design specifications of the exhaust heat recovery boiler,

main frames for supporting the heat exchanger tube bundle panel module including the main columns, the main beams and the bottom wall columns are constructed in advance at the construction site of the exhaust heat recovery boiler,

the heat exchanger tube panel modules are inserted between adjacent two main columns and the heat exchanger tube panel

support beams of the heat exchanger tube bundle panel modules are set at the setting height of the main beams at the exhaust heat recovery boiler construction site, and

the vertical module frames and the main columns, the horizontal module frame on the ceiling wall side and the main beam, and the horizontal module frame on the bottom wall side and the bottom wall columns are connected and fixed to each other.

[Claim 2]

The exhaust heat recovery boiler construction method according to Claim 1, wherein at the construction site of the exhaust heat recovery boiler, bottom wall columns having surfaces orthogonal to the gas flow and the width of which in the horizontal direction of the plane are made wider than those of the main columns, are disposed by a number enabling the bottom wall corners to be placed, and at least, on the wide portions of the bottom wall columns of both side walls, the main columns and the lower ends of the vertical module frames are placed.

[Claim 3]

The exhaust heat recovery boiler construction method according to Claim 1, wherein

when transporting the heat exchanger tube bundle panel module of the one module unit, vibration restraining fixing

members are disposed between the vibration restraining supports and the casing to become both side walls, and between the lower headers and the casing.

[Claim 4]

The exhaust heat recovery boiler construction method according to Claim 1, wherein each heat exchanger tube bundle panel module is formed into a size that enables two or more modules to be disposed adjacent to each other in the horizontal direction of a plane orthogonal to the gas flow of the exhaust heat recovery boiler, and when the vertical module frames consist of a vertical module frame disposed on the casing side and a vertical module frame disposed on the adjacent heat exchanger tube bundle panel module side, the vertical module frame and the horizontal module frames of the heat exchanger tube panel module are connected to main frames for supporting the module including the main columns, the main beams, and the bottom wall columns, the vertical module frame is removed, and furthermore, when several reinforcing module frames are located at positions facing the heat exchanger tube bundle panels on the surface side and/or the back surface side in the gas flow direction of each heat exchanger tube bundle panel module, and connect the vertical module frames, the reinforcing module frames are also removed.

[Claim 5]

The exhaust heat recovery boiler construction method according to Claim 1, wherein each heat exchanger tube bundle panel module formed into a size that enables two or more modules to be disposed in the horizontal direction of a plane orthogonal to the gas flow of the exhaust heat recovery boiler, and when first aseismic braces that connect the end portion inner side of the casing to become the ceiling wall and the central portion inner side of the casing to become the side wall of the heat exchanger tube bundle panel module respectively, and are located at positions facing the heat exchanger tube bundle panels on the surface side and/or the back surface side in the gas flow direction, and the second aseismic braces that connect the end of the casing to become the bottom wall side and the central portion inner side of the casing to become the side wall of the heat exchanger tube bundle panel module respectively, are located at positions facing the heat exchanger tube bundle panels on the surface side and/or the back surface side in the gas flow direction, the first and second aseismic braces are used not only during transportation and installation at the boiler construction site of the heat exchanger tube bundle panel modules, but also are used even after completion of the boiler installation without removing the braces.

[Claim 6]

The exhaust heat recovery boiler construction method according to Claim 5, wherein during transportation of heat exchanger tube bundle panel modules, transporting spacers are located that maintain the distances between the first and second aseismic braces and the surfaces and the back surfaces in the gas flow direction of heat exchanger tube bundle panels.

[Claim 7]

The exhaust heat recovery boiler construction method according to Claim 1, wherein each heat exchanger tube bundle boiler is formed into a size that enables two or more modules to be disposed adjacent to each other in the horizontal direction of the plane orthogonal to the gas flow of the exhaust heat recovery boiler, and when the end of the casing to become the ceiling wall side and the end of the casing to become the bottom wall side of the heat exchanger tube bundle panel module respectively are coupled to each other by a removable coupling method by a first transporting reinforcing member, and the first transporting reinforcing member and the casing to become the side wall side are coupled to each other by a removable coupling method by a plurality of second transporting reinforcing members, during transportation and installation at the boiler construction site of the heat exchanger tube bundle panel modules,

the first transporting reinforcing member and the second transporting reinforcing members are left as they are, and are removed after completion of the installation.

[Claim 8]

A heat exchanger tube bundle panel module for construction of an exhaust heat recovery boiler which generates steam by disposing a number of heat exchanger tubes inside a gas duct in that exhaust gas flows horizontally; the heat exchanger tube bundle panel module for construction of an exhaust heat recovery boiler comprising:

a plurality of heat exchanger tube bundle panels disposed along the gas flow, each including a number of heat exchanger tubes, upper and lower headers of the heat exchanger tubes, and vibration restraining supports located at predetermined intervals in a direction crossing the lengthwise direction of the heat exchanger tubes to prevent contact between adjacent heat exchanger tubes;

a casing that forms the gas duct which is attached inside with a thermal insulating material covering the outer peripheral portion consisting of the ceiling wall, the bottom wall, and both side walls along the gas flow of the plurality of heat exchanger tube bundle panels;

heat exchanger tube bundle panel support beams located

outside the ceiling wall of the casing to become the ceiling wall at the time of installation at the boiler construction site;

header supports that penetrate the ceiling wall of the casing and connect the upper headers and the heat exchanger tube bundle panel support beams to hang the upper headers down;

vertical module frames as vertical support members for the heat exchanger tube bundle panels located outside the casing to become both side walls at the time of installation at the boiler construction site; and

horizontal module frames as horizontal support members for the heat exchanger tube bundle panels located outside the ceiling wall and outside the bottom wall of the casing to become the ceiling wall and bottom wall at the time of installation at the boiler construction site, wherein

when installing the exhaust heat recovery boiler at the construction site, a heat exchanger tube bundle panel module formed into a size enabling two or more modules to be disposed adjacent to each other in the horizontal direction of a plane orthogonal to the gas flow of the boiler is set as one module unit, and among main frames for supporting modules including main columns, main beams, and bottom wall columns to be constructed in advance at the construction site of the exhaust



heat recovery boiler, the main columns and the vertical module frames, the main beams and the horizontal module frame on the ceiling wall side, and the bottom wall columns and the horizontal module frame on the bottom wall side can be connected and fixed to each other.

[Claim 9]

The heat exchanger tube bundle panel module for construction of an exhaust heat recovery boiler according to Claim 8, wherein

the module frames consist of a vertical module frame to be disposed on the casing side and a vertical module frame to be disposed on the adjacent heat exchanger tube bundle panel module side, and

a plurality of reinforcing module frames are located at positions facing the heat exchanger tube bundle panels on the surface side and/or the back surface side in the gas flow direction of each heat exchanger tube bundle panel module, connect the vertical module frames, and are removed after installation of the boiler.

[Claim 10]

The heat exchanger tube bundle panel module for construction of an exhaust heat recovery boiler according to Claim 8, wherein

the vertical module frame consists of a vertical module frame to be disposed on the casing side, and includes first aseismic braces that connect the end portion inner side of the casing to become the ceiling wall and the central portion inner side of the casing to become the side wall casing, and are positioned to face the heat exchanger tube bundle panels on the surface side and/or the back surface side in the gas flow direction of each heat exchanger tube bundle panel module, and second aseismic braces are located which connect the end of the casing to become the bottom wall side and the central portion inner side of the casing to become the side wall side, and are positioned to face the heat exchanger tube bundle panels on the surface side and/or the back surface side in the gas flow direction.

[Claim 11]

The heat exchanger tube bundle panel module for construction of an exhaust heat recovery boiler according to Claim 8, wherein the vertical module frames is located with a first transporting reinforcing member that couples the end of the casing to become the ceiling wall side and the end of the casing to become the bottom wall side to each other, and is removed after completion of installation in the boiler, and a plurality of second transporting reinforcing members that

couple the first transporting reinforcing member and the casing to become the side wall side to each other and are removed after completion of installation in the boiler, positioned to face the heat exchanger tube bundle panel modules on the surface side and/or the back surface side in the gas flow direction of the respective heat exchanger tube bundle panels.

[Claim 12]

The heat exchanger tube bundle panel module for construction of an exhaust heat recovery boiler according to Claim 8, wherein at the coupling portion between both ends of the casing to become the ceiling wall side and the bottom wall side and the first transporting reinforcing member and the coupling portion between the side wall side casing and the second transporting reinforcing members, fitting coupling is applied to coupling portions where a compressive load acts, and bolt coupling is applied to coupling portions where a tensile load acts.

[Claim 13]

The heat exchanger tube bundle panel module for construction of an exhaust heat recovery boiler according to Claim 8, wherein bolt coupling is applied to both the coupling portion between both ends of the casing to become the ceiling wall side and the bottom wall side and the first transporting

reinforcing member and the coupling portion between the casing to become the side wall side and the second transporting reinforcing members.

[Claim 14]

The heat exchanger tube bundle panel module for construction of an exhaust heat recovery boiler according to Claim 8, wherein vibration restraining fixing members are disposed between the vibration restraining supports and the casing and between the lower headers and the casing.

[Claim 15]

The heat exchanger tube bundle panel module for construction of an exhaust heat recovery boiler according to Claim 8, wherein baffle plates are attached to both side surfaces of a plane orthogonal to the gas flow direction of the heat exchanger tube bundle panels of each heat exchanger tube bundle panel module, respectively, and between the heat exchanger tube bundle panels of two modules to be disposed adjacent to each other in the horizontal direction of a plane orthogonal to the gas flow, gas short pass preventive plates which are connected at one side surfaces to the baffle plates of one heat exchanger tube bundle panels, and come into contact at the other side surfaces of the baffle plates of the other heat exchanger tube bundle panel are attached.

[Claim 16]

The heat exchanger tube bundle panel module for construction of an exhaust heat recovery boiler according to Claim 15, wherein the side surfaces of the gas short pass preventive plates to come into contact with the baffle plates of each heat exchanger tube bundle panel are bent toward the upstream side of the gas flow.